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Functional Anatomy of *Bankia fimbriatula* Moll & Roch, 1931 (Bivalvia: Teredinidae)

MARIA JÚLIA MARTINS-SILVA[1] AND WALTER NARCHI[†]

[1]Departamento de Zoologia da Universidade de Brasília, Campus Universitário, Asa Norte, 70910-900 Brasília, DF, Brazil (e-mail: mjsilva@unb.br)

Abstract. *Bankia fimbriatula* Moll & Roch, 1931, is a highly specialized bivalve adapted for boring into wood. Specimens were collected alive from a mangrove region at Praia Dura, Ubatuba, São Paulo, Brazil and maintained in an aquarium at room temperature (21°C) at the laboratory of the Department of Zoology, University of São Paulo. Studies of the anatomy were carried out on both relaxed and preserved specimens. Special attention was paid to the siphons, pallets, ctenidia, labial palps and mantle. The siphons are fairly long, and separated. The inhalant and exhalant siphons have ciliary activity at the tentacles, as described previously for *Nausitora fusticula* (Jeffreys, 1860). The posterior ctenidia are homorhabdic. Each ctenidium of *B. fimbriatula* is formed by the external demibranch only, with the blades in a "V" form. The ctenidia, associated with the rejection tracts of the mantle, present a good mechanism to deal with large quantities of particles, probably an adaptation for life in turbid waters. The labial palps are extremely reduced. The functional anatomy of *B. fimbriatula* suggests that both plankton and wood probably are important as food for this species.

INTRODUCTION

The anatomy of species of Teredinidae has been studied by several authors, including Quatrefages (1849), Menegaux (1889), Ridewood (1903), Sigerfoos (1908), Potts (1923), Lazier (1924), Atkins (1937), Purchon (1939, 1941, 1960), Nair (1957), Bade et al. (1961, 1964a, 1964b), Turner (1966), Rancurel (1971), Saraswathy & Nair (1971), Lopes & Narchi (1998) and Lopes et al. (1998). Some references [Atkins (1937), Purchon (1941, 1960), Clapp (1951), Morton (1970, 1978), Martinez (1987), Lopes & Narchi (1998) and Lopes et al. (1998), are restricted mainly to the structure and function of specific organs.

The functional anatomy of *Bankia fimbriatula* Moll & Roch, 1931, is the main focus of this work; we analyzed the functioning of the siphons, the muscles associated with the siphons and pallets, and the ciliary currents related to the selection of food and particles for elimination. A detailed study of the anatomy and function of the stomach will be presented in a separate paper.

Bankia fimbriatula occurs mainly in tropical warm waters around the world (Turner, 1966). On the Brazilian coast it has been reported from the littoral zone of São Paulo State (Lopes & Narchi, 1998), Paraná State (Müller & Lana, 1986, 1987; Skinner et al., 1993) and Rio de Janeiro State (Silva et al., 1989; Junqueira et al., 1989; Martins-Silva et al., 1990 and Junqueira & Silva, 1991).

The genus *Bankia* Gray, 1842, includes twenty-three species (Turner, 1971) in the subfamily Bankiinae Turner, 1966, thirteen of which occur in the Brazilian littoral.

Among species of *Bankia*, Sigerfoos (1908) studied the anatomy of *Xylotrya gouldi* [= *Bankia gouldi* (Bartsch, 1908)], Clapp (1951) made observations on living Teredinidae and described the siphons of *B. gouldi*. Bade et al. (1961) illustrated and described the mantle of *Bankia minima* [= *Bankia carinata* (Gray, 1827); Turner (1966, 1971)]. Bade et al. (1964a, 1964b) studied the digestive and respiratory systems of the same species. Turner (1966) described the posterior region of *B. gouldi*, and described the anatomy of *Bankia setacea* (Tryon, 1863), *B. campanellata* Roch & Moll, 1931, and *B. australis* (Calman, 1920). Saraswathy & Nair (1971) described the anatomy of *B. indica*. Tan et al. (1993) made a study of the shell and pallets of the early developmental stages of *B. gouldi*.

This paper presents the first anatomical study of *Bankia fimbriatula*.

MATERIAL AND METHODS

Specimens of *B. fimbriatula* were collected during 1992 and 1994 in mangrove trees at Praia Dura, Ubatuba, São Paulo, Brazil (45°15′W, 23°30′S) (Figure 1). This is the second most abundant species of Teredinidae in the area, living at a salinity range from 0–33‰ (Lopes & Narchi, 1993). The animals were kept inside the wood, in a seawater aquarium with constant aeration and at a salinity of 20‰ and a room temperature of 22°C, where

[†]Dr Walter Narchi (died in 2004)

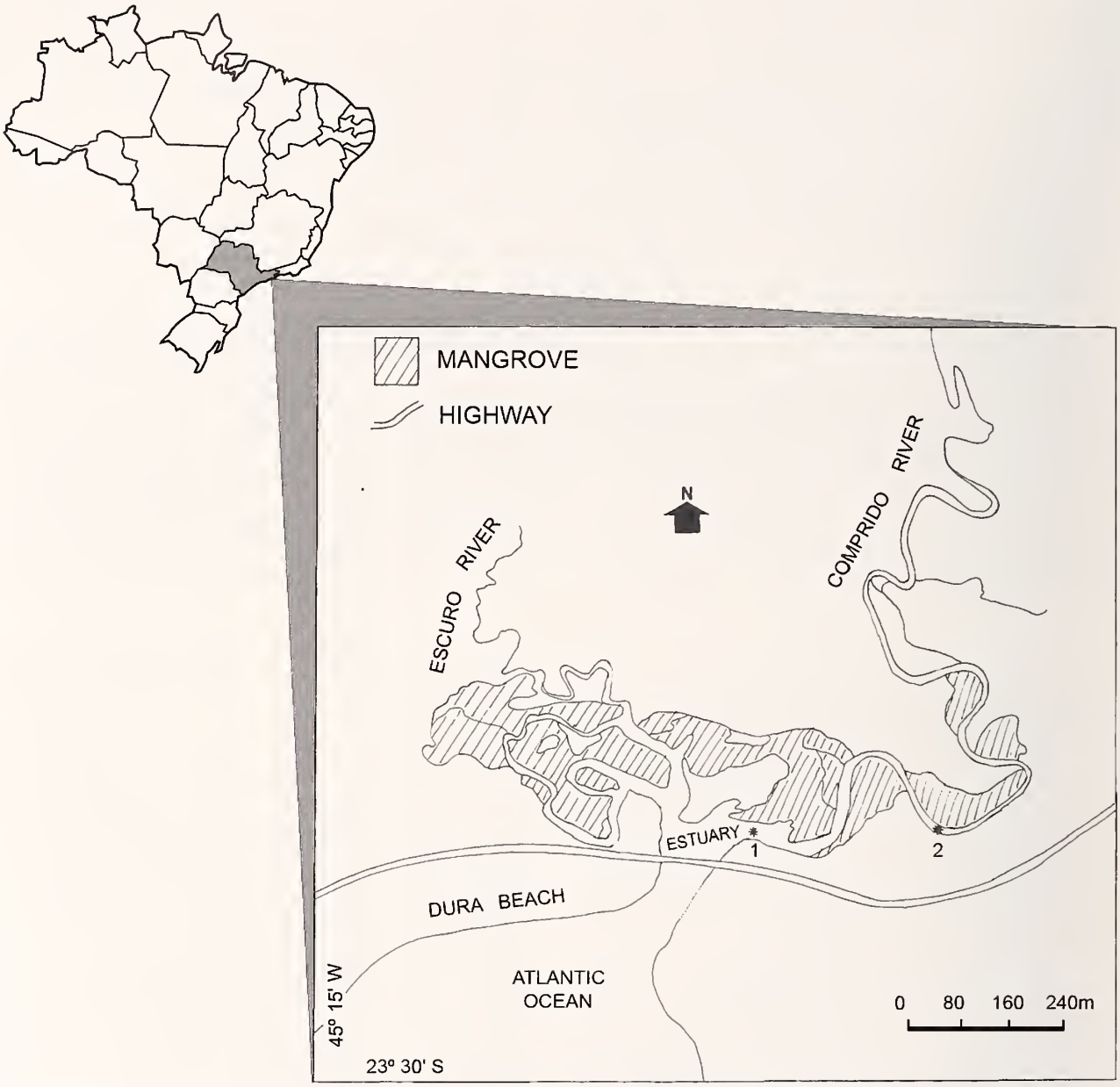

Figure 1. Map of the mangrove region at Praia Dura, Ubatuba, São Paulo, Brazil, with indications of the collection stations (*1 and 2).

they stayed in good condition for almost two years. The study of the functional anatomy was conducted at the University of Brasilia where the animals were kept alive in an aquarium with artificial seawater.

Around 50 living and preserved specimens specimens of all sizes were analyzed. Identification of the material was based on Clench & Turner (1946) and Turner (1966, 1971). Identification was confirmed by the late Dr. Ruth D. Turner, Harvard University, USA. A lot of 15 complete specimens (shell, pallets and soft parts) were deposited in the Museu de Zoologia, Universidade de São Paulo (MZ USP) under the registration number 32061.

Ciliary currents were studied by the application of a suspension of Carborundum (F3), carmine and Aquadag solutions. To help the observation of the different organs, whole animals were stained with Paracarmin and later cleared (Bücherl, 1943).

Some of the anatomical details analyzed were also obtained by transverse sections 6–8 μm thick, of

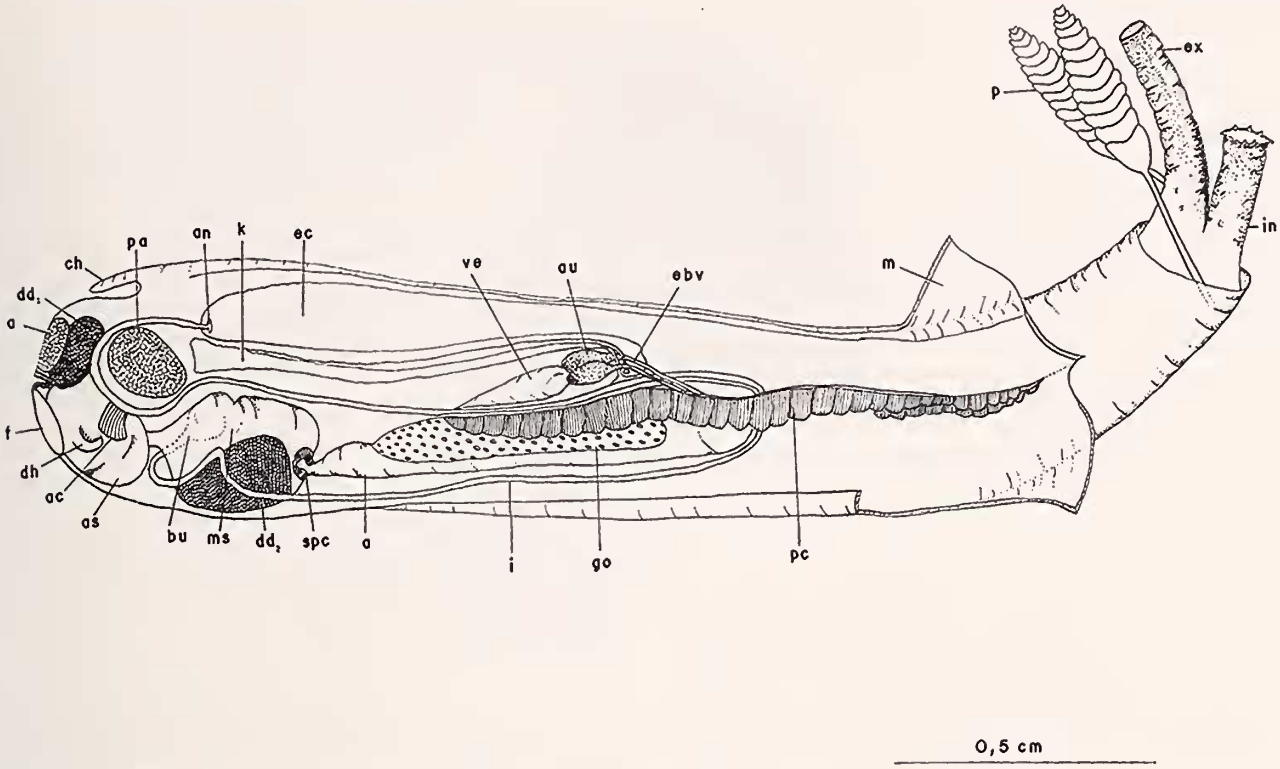

Figure 2. *Bankia fimbriatula*. General topography of the organs after removal of the valve and the mantle from the left side of the body. Abbreviations: a, appendix; aa, anterior adductor muscle; ac, anterior ctenidium; an, anus; as, anterior stomach; au, auricle; bu, bulblike swelling; ch, cephalic hood; dh, dorsal hood; dd_1, dd_2, digestive diverticles; ec, epibranchial cavity; ebv, efferent branchial duct; ex, exhalant siphon; f, foot; go, gonad; i, intestine; in, inhalant siphon; k, kidney; m, mantle; ms, meddian stomach; p, pallet; pa, posterior adductor muscle; pc, posterior ctenidium; spc, semi-spiral conical projection; vc, ventricle.

animals fixed in Bouin's fluid and stained with Mallory's Triple Stain or Ehrlichs's haematoxylin and eosin, according to the method described by Pantin (1948).

RESULTS

General disposition of organs in the mantle cavity

The disposition of the major organs in the mantle cavity of *B. fimbriatula* is shown in Figure 2.

The visceral mass occupies about 60% of the body length and the posterior ctenidia and siphons occupy the remainder.

The stomach has two regions; the appendix or wood-storing caecum is well developed and in the live animal is easily distinguished from the other structures because of its reddish color due to particles inside it.

The digestive diverticula are of two types as defined by Potts (1923) and Morton (1970) for *Teredo navalis* (Linnaeus, 1758): the normal type and the specialized type. In live specimens of *B. fimbriatula* there is no difference between the digestive diverticula in contrast to what Lopes & Narchi (1998) described for *Nausitora fusticula* (Jeffreys, 1860). In *B. fimbriatula* the differences are only distinct in histological sections.

Males and females have milky white gonads, situated at the region immediately posterior to the distal part of the digestive diverticula.

Contrary to what Turner (1966) states for *B. gouldi*, *B setacea*, *B. campanellata* and *B. australis*, the heart of *B. fimbriatula* has two intensely dark brown pigmentated atria. The ventricle is whitish in color and from it arises a well-developed aorta located on the dorsal surface of the gonads.

The kidney is dorsal to the aorta, extending from the posterior part of the posterior adductor muscle to the distal extremity of the pericardial cavity. The nephrostome opens into the interior of the pericardial cavity and the nephridiopores into the epibranchial cavity, both at the same level of the body. The afferent excretory duct shows, just behind the nephrostome, a globular dilatation whose internal wall is deeply folded and ciliated. The two nephridiopores are placed near each other, being smaller than, and situated posteriorly to, the gonopores.

The anal canal lies in the dorsal region of the visceral mass and extends from the anus to the posterior end of

the gonads, connecting to the epibranchial cavity through a narrow opening.

Shell

The descriptive terminology of the shell is based on Turner (1966). Less than half the external surface of the shell of *B. fimbriatula* (Figure 3) is occupied by the anterior slope. The dorsal region possesses denticulate ridges that are eroded by friction against wood; laterally these ridges are more developed. The umbonal-ventral sulcus is narrow and flat. The dorsal and ventral condyles are obvious, but the umbonal-ventral ridge is poorly defined. The apophysis is flat when viewed transversely, with a sharp extremity near the ventral condyle. The posterior adductor muscle scar is only weakly evident.

Pallets

The pallets of *B. fimbriatula* (Figure 4) possess a long stalk, of the same length as or shorter than the blade. The pallets are elongate and the blades are composed of numerous cone-like elements on a central stalk; these elements are separated and easily removed from the stalk, particularly in dried specimens. The cones have a calcareous base covered with periostracum, which extends as a border. The width and the ornamentation of the periostracal border vary greatly; the border may be smooth, coarsely to finely serrate, or produced laterally as awns.

Variations in the form of the blade could not be related to the age of the animals or to environmental conditions. As all specimens came from the same population and similar ecological conditions this can be interpreted as individual variation, as Lopes & Narchi (1998) observed for *Nausitora fusticula*.

Siphons

As described for *N. fusticula* the inhalant and exhalant siphons (Figure 5) are joined for almost half of their length (Lopes & Narchi, 1998). Most of the specimens have white siphons with small spots of reddish brown pigmentation from the region of separation of the siphons to the aperture. This pigmentation is more abundant on the ventral sides of the inhalant siphon and on the dorsal side of the exhalant.

The inhalant siphon (Figure 6) is fringed with a row of eight digitiform tentacles, between which the epithelium forms simple projections. When the animal is pumping water, the siphons project through the wood, and the digitiform tentacles are kept almost perpendicular to the axis of the siphons.

The exhalant siphon possesses a relatively narrow opening whereas the margin is smooth and lacks digitiform projections. The exhalant siphon stretches and moves more actively than the inhalant, the latter stayed in the same position for a long period, moving only when disturbed or in order to quickly close the opening by flexing the digitiform projections. This movement apparently occurred without tactile stimulus and was not regular.

The cilia on the siphons (Figure 7) occur mainly on the digitiform projections and the epithelium at the inhalant and the extremity of the exhalant siphons and produce a weak rejecting current that transports small particles outwards. Thus, these cilia contribute to cleaning the tentacle surface, impeding the settling of small particles.

Bankia fimbriatula eliminates fecal pellets and pseudofeces via small jets. The exhalant and inhalant siphons, respectively, eject them a short distance away from the opening in the wood, where generally they accumulate. In the aquarium, large quantities of this waste accumulate, requiring weekly removal.

Musculature of the pallets and siphons

The musculature involved in moving the pallets and siphons (Figure 8) was described by Turner (1966) for *Bankia gouldi* and *B. setacea*. In *B. fimbriatula*, the musculature is similar to that of *B. gouldi* and includes the protractors, anterior retractors, median and posterior retractors and adductor muscles. These muscles unique to the Teredinidae are fixed to the proximal third part of the pallet stalk.

The protactor muscle (pmp) of each pallet is composed of two well-developed bundles, easily seen externally as an open fan shape, with the narrower part directed to the anterior region of the animal. The muscle itself is fixed to the stalk and to the calcareous part of the gallery wall.

The anterior retractor muscle (armp) of pallet is formed by two muscular bundles, the thicker "internal" and the thinner "external." The internal is fixed to the internal face of the stalk and the external is fixed to the external face of the stalk.

The posterior retractor muscle (prmp) is slim with little branching. The posterior retractor muscle ends inside the mantle and is not attached to any hard structure.

The adductor muscle of the pallets (amp), the extremities of which are fixed to the internal face of the stalk, bring together the two pallets.

In the body region where the musculature of the pallets occurs, it is possible to observe two well developed cylindrical muscular bundles of the retractor muscles of the siphon (rms).

When the animal is pumping water, the pallets remain inside the gallery. Any disturbance in the environment causes retraction of the siphons. At this

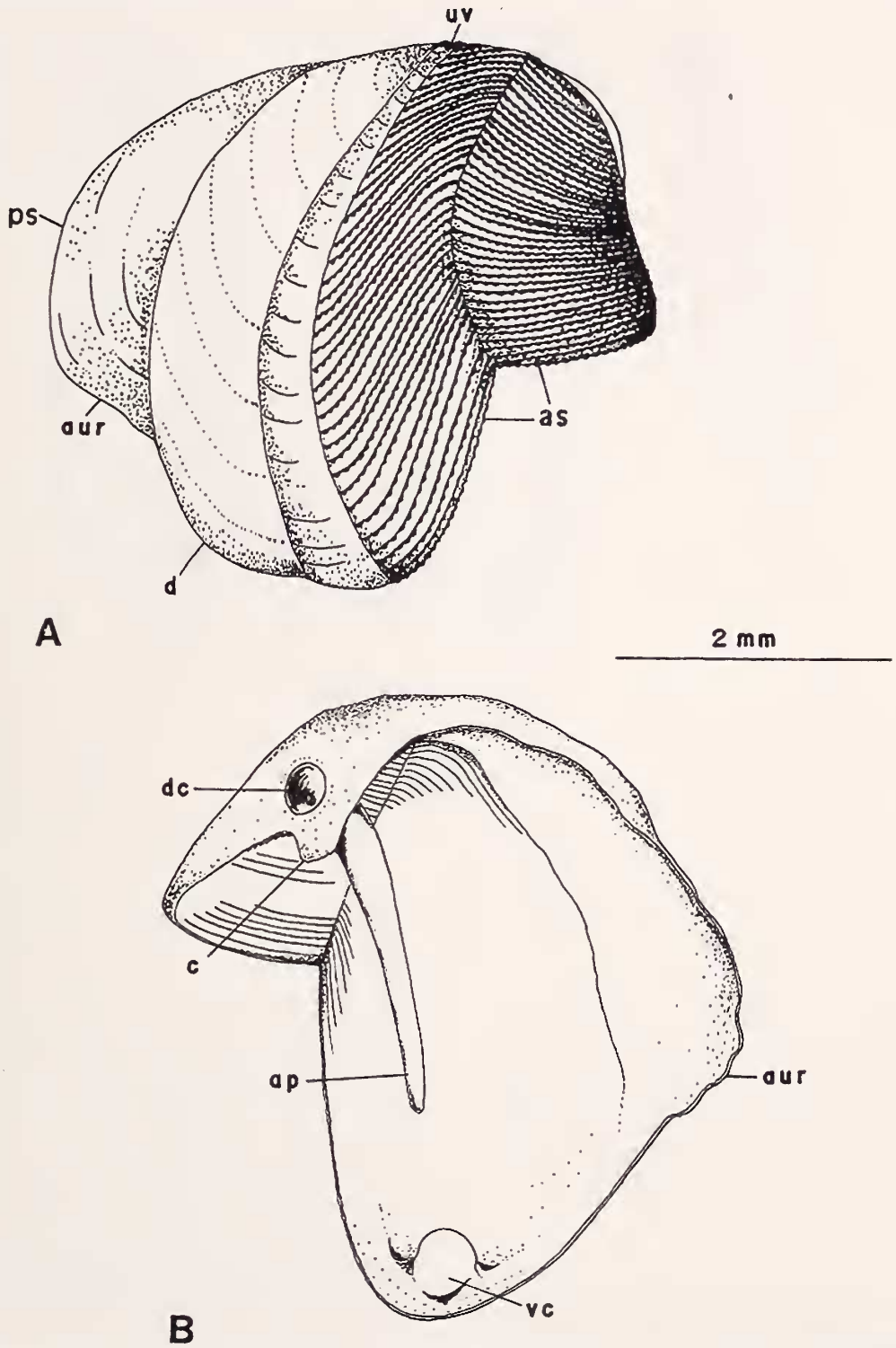

Figure 3. *Bankia fimbriatula*. Right valve of the shell. A. External view. B. Internal view. Abbreviations: ap, apophysis; as, anterior slope; aur, auricle; c, chondrophore; d, disc; dc, dorsal condyle; ps, posterior slope; vc, ventral condyle; vu, ventral umbonal sulcus.

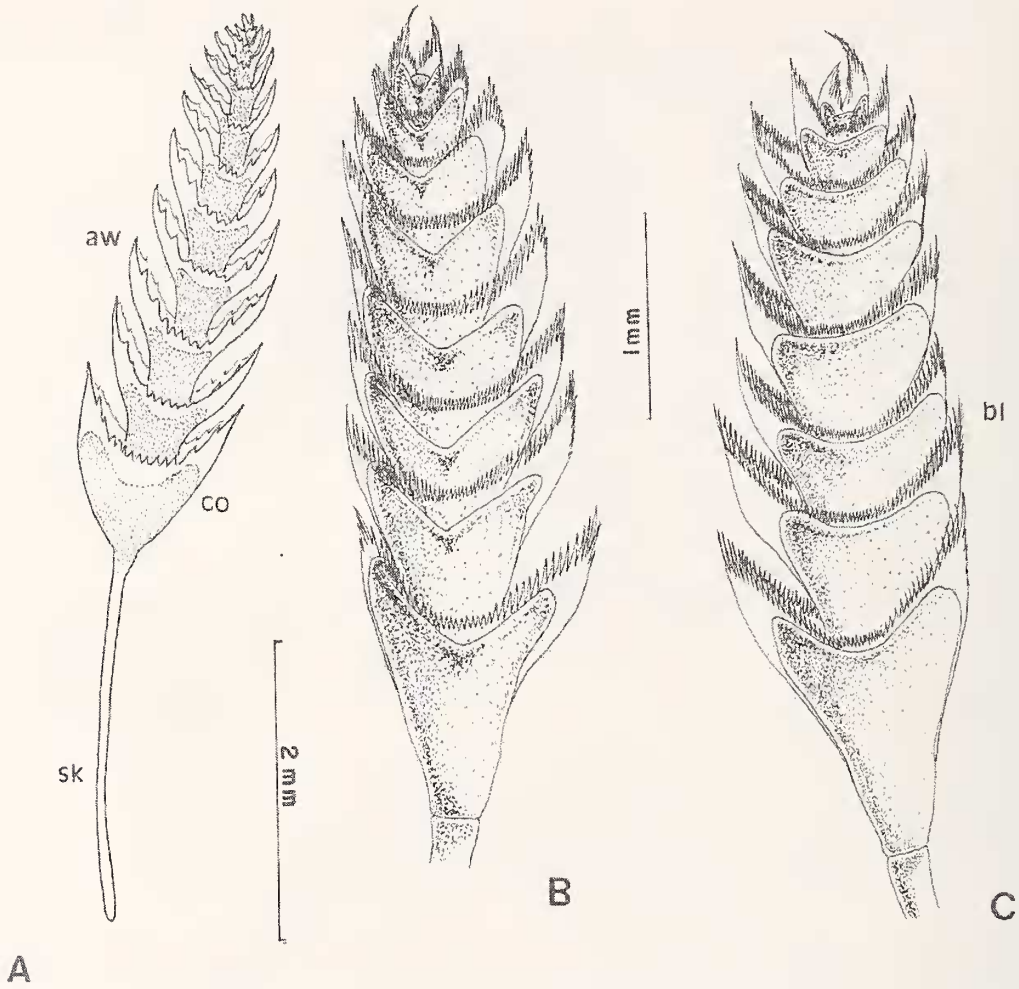

Figure 4. *Bankia fimbriatula*. Variations in the pallet. A. Pallet with complete peduncle. B. External view of the pallet. C. Internal view of the pallet. Abbreviations: aw, awns; bl, blade; co, cone; sk, stalk.

time, the pallets are pushed into the opening of the gallery by contraction of the pallet protractor muscles. When the disturbance ceases, the pallets retract and the siphons extend out to the exterior. Pallet retraction is executed by retractor muscles at the same time that the adductors contract, thus moving the pallets' blades apart, allowing for passage of the siphons. During this process, the protractor muscle of the pallet and the retractors of the siphons remain relaxed.

Mantle

The structure of the mantle is similar throughout the family (Turner, 1966). In *B. fimbriatula* the mantle is thin and transparent in the anterior third of the body. At the median third it is a little thicker, while at the posterior third, it is very thick. The tissue of the mantle is filled with a whitish substance. Groups of round granules of a reddish-brown color, as described by Lopes & Narchi (1998) in *N. fusticula*, are not present in *B. fimbriatula*.

In the hypobranchial cavity at each side of the body, the internal epithelium of the mantle has a tract with well-developed cilia that extends from the anterior region to the base of the inhalant siphon. In the anterior and median regions of the body, these tracts are lateral. At the beginning of the posterior ctenidia they approach one another, meeting and becoming ventral.

The mantle in the epibranchial cavity dorsal to the posterior ctenidia, near the siphons, has internally a thick zone of mucus cells, as also described by Nair (1957) and Saraswathy & Nair (1971) for *B. carinata*.

Labial palps

The labial palps of *B. fimbriatula* (Figure 9) are attached to the epithelium of the visceral mass (Turner, 1966). They are inconspicuous, the external and the

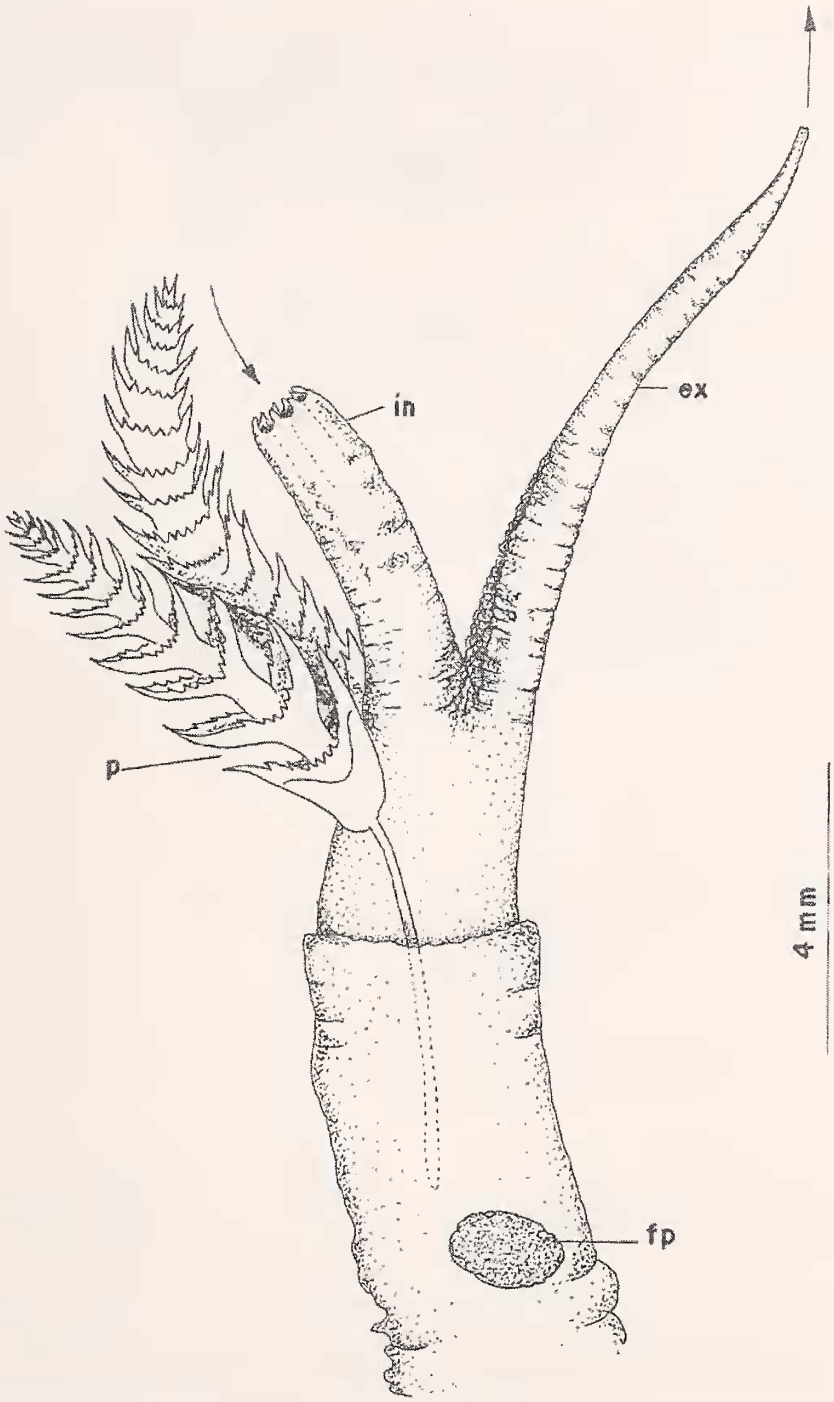

Figure 5. *Bankia fimbriatula*. Siphons and pallets as observed in living animal removed from the wood. Abbreviations: fp, fecal pellet; in, inhalant siphon; ex, exhalant siphon; p, pallet. The arrows show the direction of the inhalant and exhalant currents.

internal ones occupying, respectively, dorsal and a ventral positions. The dorsal palp is reduced to two flat folds. The ventral palp is reduced to a small, long and narrow elevation extending from the ventral border of the mouth to the anterior extremity of the marginal groove. Identification of the palps was possible only for some specimens.

The ciliary currents were observed only in a few specimens. Ciliary activity was slight and movements of the particles near the mouth were not detected.

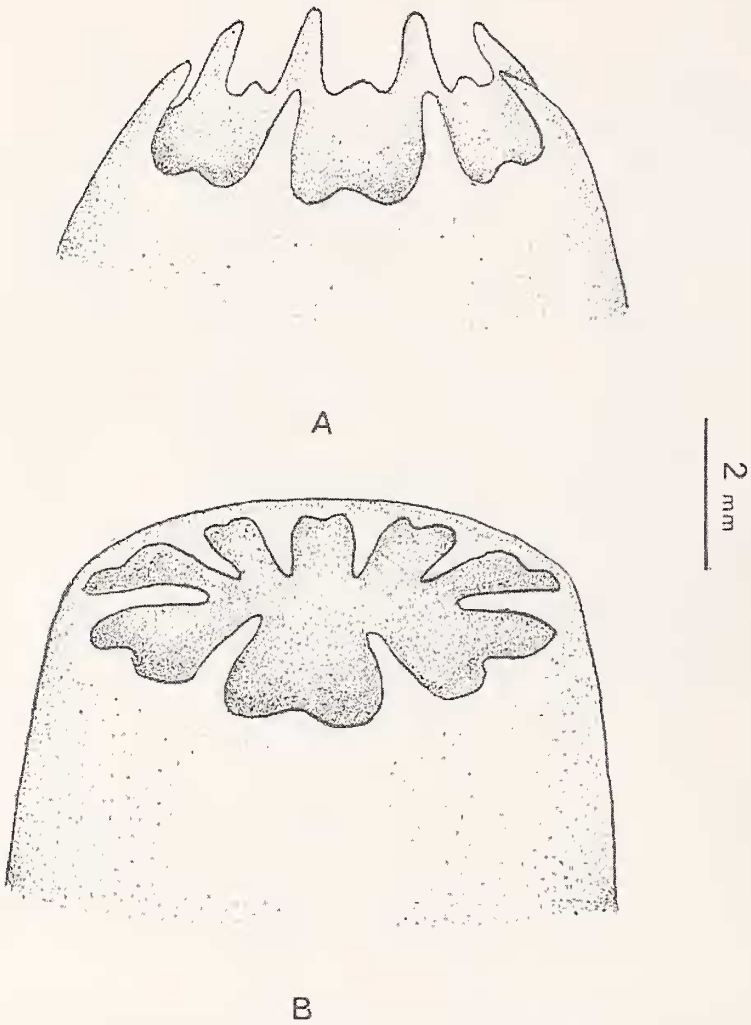

Figure 6. *Bankia fimbriatula*. Detail of the aperture of the inhalant siphon with eight digitiform tentacles. A. Siphon opened with extended tentacles. B. Siphon showing tentacles bending across the aperture.

Ctenidia

The terminology adopted for the description of the ctenidia of *B. fimbriatula* is the same used by Ridewood (1903); Atkins (1937); Purchon (1939) and Lopes & Narchi (1998).

The anterior ctenidia have from eight to nine filaments that correspond to those of the external lamella of the demibranch (Figure 10). Each filament is reduced to a simple bar, joined throughout its length to the epithelium of the visceral mass. The first and the last filaments are really semi-filaments because there is complete ciliation on only one of the lateral faces, as Sigerfoos (1908) described for *B. gouldi*.

Depending on the condition of the body contraction, the ctenidium may become strongly folded, simulating a plait (Figure 11). The body of *B. fimbriatula* can contract to half its length in preserved animals or even in live ones removed from wood. The posterior part of the body is more affected by this contraction and the ctenidia become shorter and folded. The posterior ctenidia of *B. fimbriatula* are similar to those described by Lopes & Narchi (1998) for *N. fusticula*.

The posterior ctenidia are represented only by the external demibranch [Purchon (1939, 1941) and Lopes & Narchi (1998)].

The demibranchs of *B. fimbriatula* are eulamellibranch and homorhabdic. Each demibranch has a V-shaped form; the apex possesses a marginal groove 95 μm deep.

Each filament of the posterior ctenidia measures 40.8 μm in width along practically its entire length. The free extremity is slightly dilated. Each filament (Figures 12, 13) has two bands of frontal cilia (fc) laterally disposed, each of which measures around 6.8 μm in length, bordered by two rows of lateral-

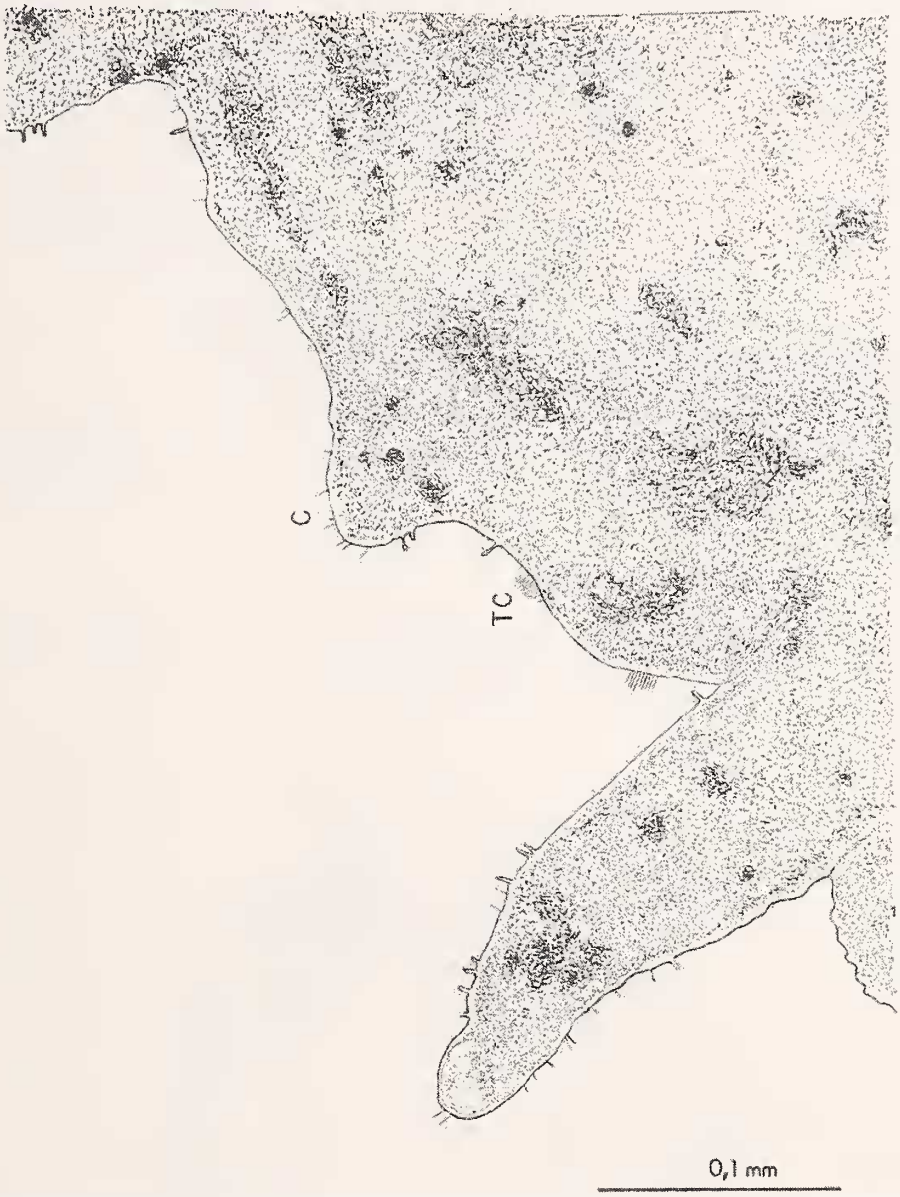

Figure 7. *Bankia fimbriatula.* Rim of the inhalant siphon showing one digitiform tentacle and one simple projection occurring between two tentacles. Abbreviations: c, cilia; tc, cilia tufts.

frontal cilia (lfc) of around 50 µm in length; laterally, between the base of the filament and the lateral-frontal cilia, there are lateral cilia (lc) around 23.8 µm in length forming on each face a strip about 20.4 µm in width. The frontal cilia of the lateral regions of the free extremity of the filaments are the same length and cover the top of the filaments. In this region, there are no large cilia which could be identified as being terminal. The rows of lateral-frontal and frontal cilia end at the marginal groove base and are of similar length as the frontal cilia.

The posterior demibranchs of *B. fimbriatula*, joined by their respective ctenidial axes, separate at the posterior region of the visceral mass. The filaments become progressively smaller until they are reduced to the marginal groove. This groove is situated laterally on the visceral mass it extends to the anterior ctenidia, and is bordered by ciliated cells.

In the anterior and median regions of the body the ctenidia are reduced to a marginal groove. The quantity of material transported inside the marginal groove is generally small. Excess particles are conducted to the anterior region where they accumulate, surrounded by mucus, and formed into large masses, which flow from

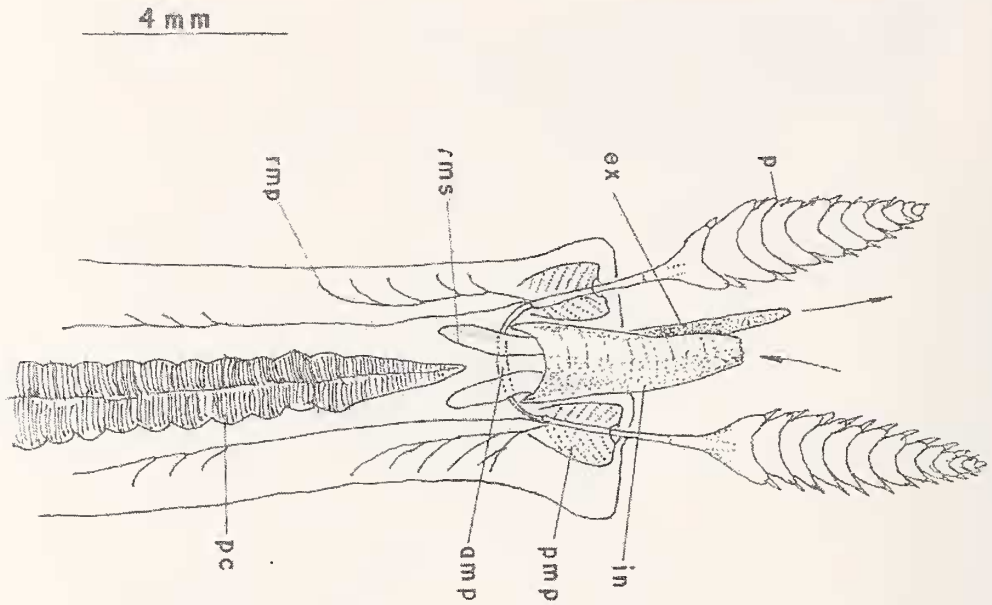

Figure 8. *Bankia fimbriatula*. Diagrammatic view of the muscles associated to the pallets and siphons. Abbreviations: amp, adductor muscle of the pallet; ex, exhalant siphon; in, inhalant siphon; p, pallet; pc, posterior ctenidia; pmp, protractor muscles of the pallet; rms, retractor muscle of the siphon; rmp, retractor muscle of the pallets.

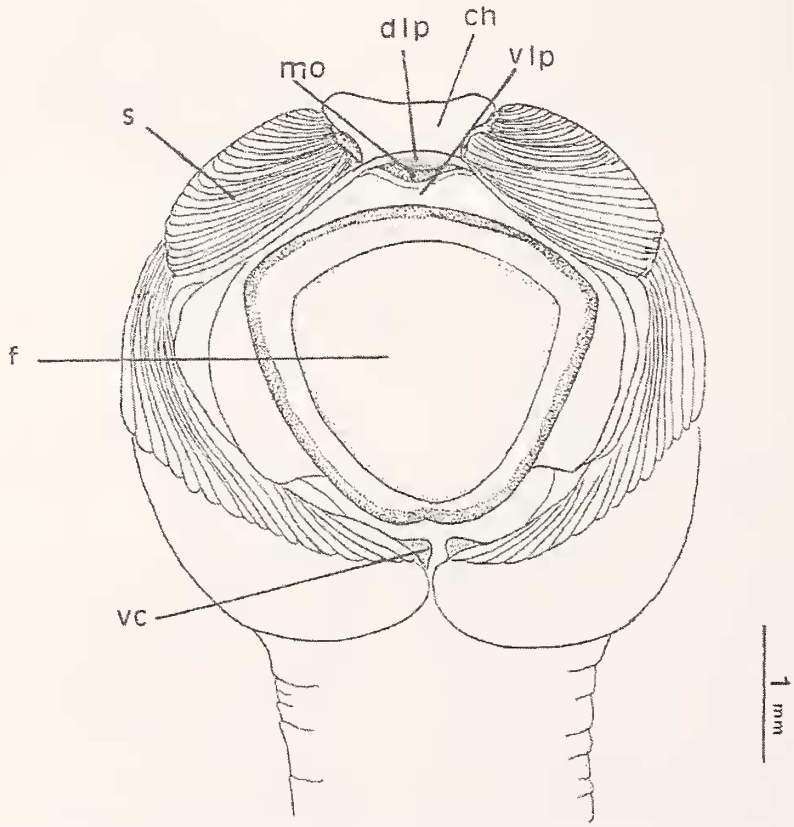

Figure 9. *Bankia fimbriatula*. Frontal view of the anterior extremity. Abbreviations: ch, dorsal hood; dlp, dorsal labial palp; f, foot sole; mo, mouth; s, shell; vc, ventral condyle; vlp, ventral labial palp.

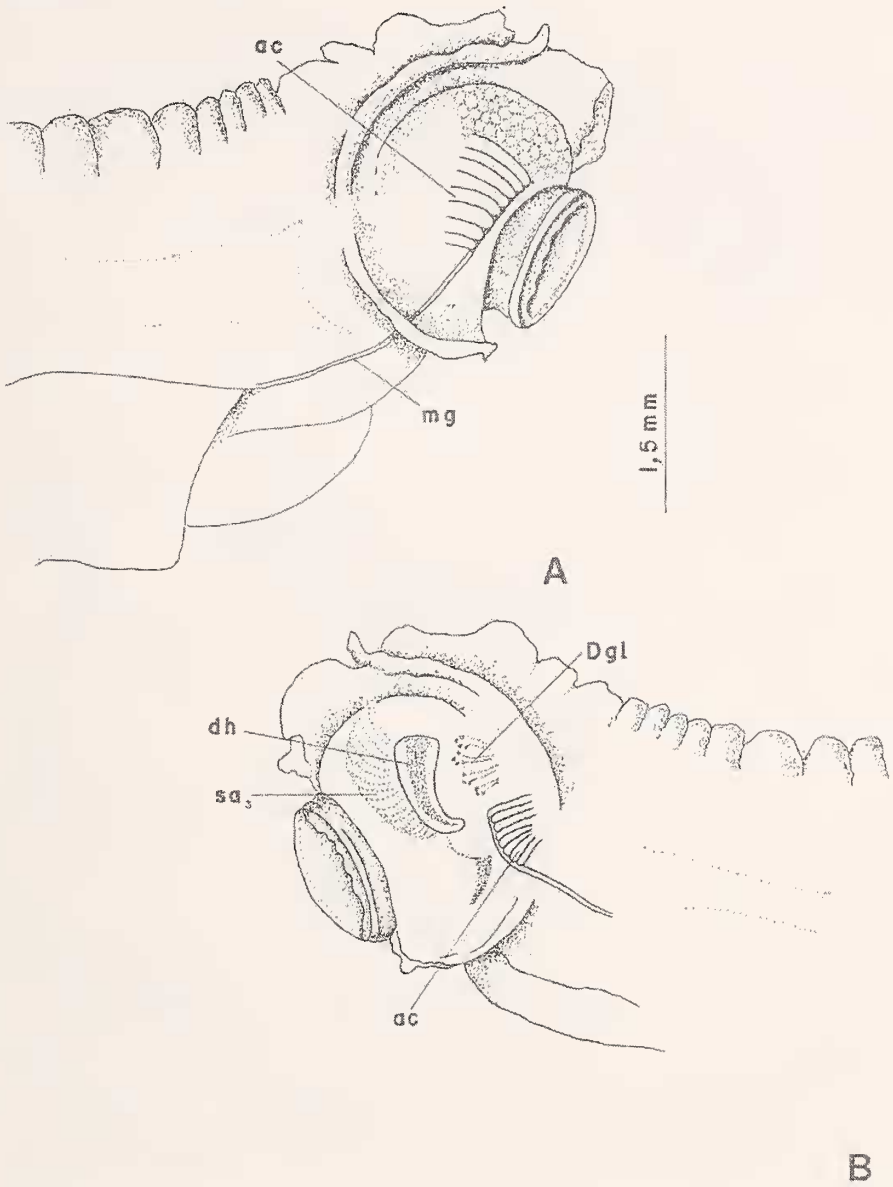

Figure 10. *Bankia fimbriatula*. Topography of the anterior region of the body after removal of the valves and submitted the animal to a process of diaphanization. A. View from the right side. B. View from the left side. Abbreviations: ac, anterior ctenidia; Dgl, Deshayes glands; dh, dorsal hood; mg, marginal groove; sa_3, sorting area sa_3.

inside the groove. These masses are then transported by the cilia of the rejection tract of the mantle and eliminated.

Ciliary Currents

On the filament of each demibranch of the posterior ctenidia, the lateral cilia produce strong water currents, which aid in respiration and feeding. On one face of the filament these cilia produce a ventrally-directed current, and on the other, a dorsally-directed one. The lateral-frontal cilia project toward the sides of the filaments and alternatively cross with the adjacent filaments to form a type of grating. The lateral cilia beat from the inside out onto the interfilamentar spaces, throwing particles onto the frontal faces of the filament. From here the particles are transported by the two lateral rows of the frontal cilia and large particles are prevented from penetrating in the interior of the demibranchs. The frontal cilia on the external and internal blade of each demibranch conduct particles of different sizes to the ventral region. At the ventral extremity of the filaments, small particles are moved by the cilia from the lateral faces to the interior of the marginal groove and conducted to the

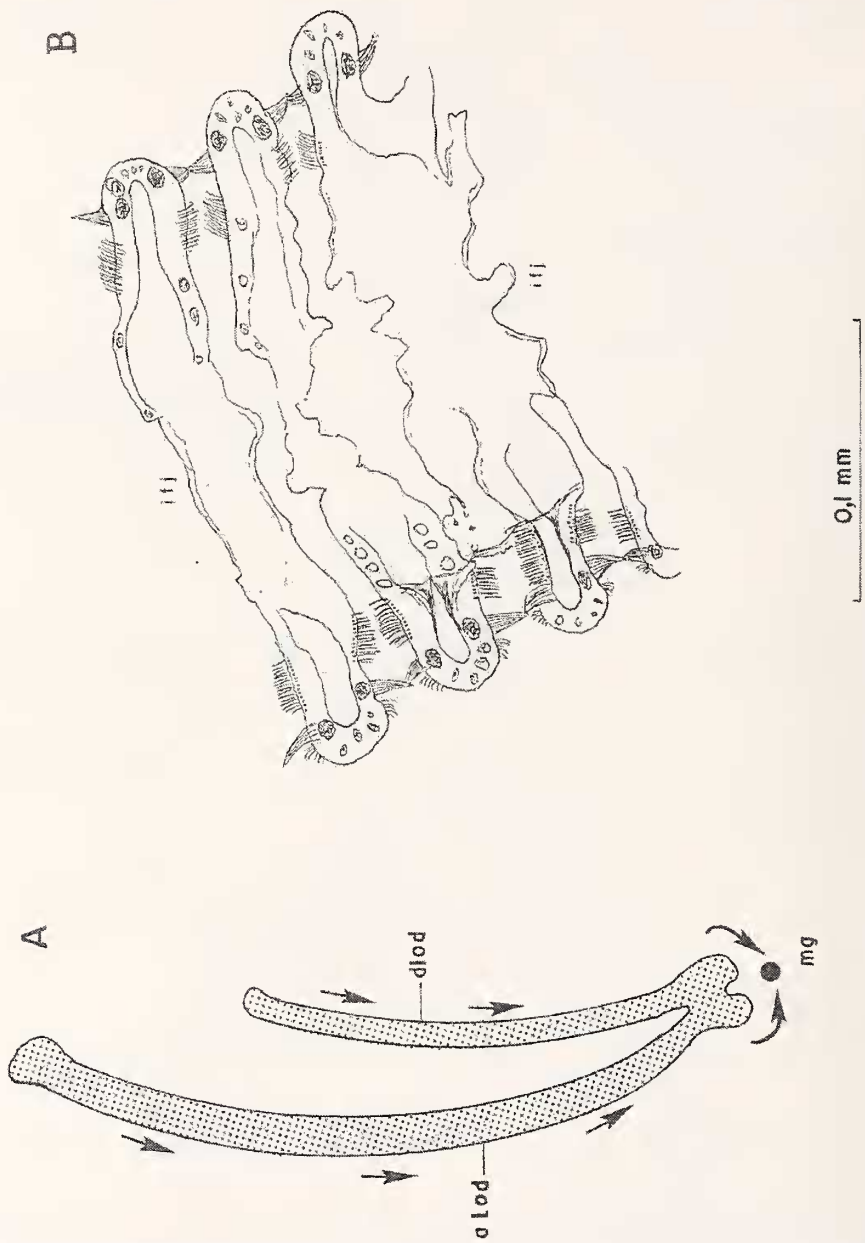

Figure 11. *Bankia fimbriatula*. Posterior ctenidium. A. Diagrammatic vertical section through the ctenidium to show the mode of action of the frontal cilia. B. horizontal section to show the homorhabdic condition of the ctenidium. Abbreviations: alod, ascendent lamella of the outer demibranch; dlod, descendent lamella of the outer demibranch; ifj, interfilamentar junction; mg, marginal groove.

anterior region by a strong ciliary current. Larger particles are conducted anteriorly at the free edge of the demibranch and outside the marginal groove. Opening and closing of the marginal groove were not observed to control the quantities of particles within. Depending on the distance of the marginal groove from the mantle rejection tracts, the strong ciliary currents of these tracts directly captured particles from outside the marginal groove. Particles that form large masses that fall into the hypobranchial cavity are collected by the rejection tract. These masses are retained by the cilia of the rejection tract of the mantle and then eliminated.

Weak ciliary activity was observed in the mid-region of the visceral mass in a few specimens of *B. fimbriatula*, particles being conducted forward in the marginal groove.

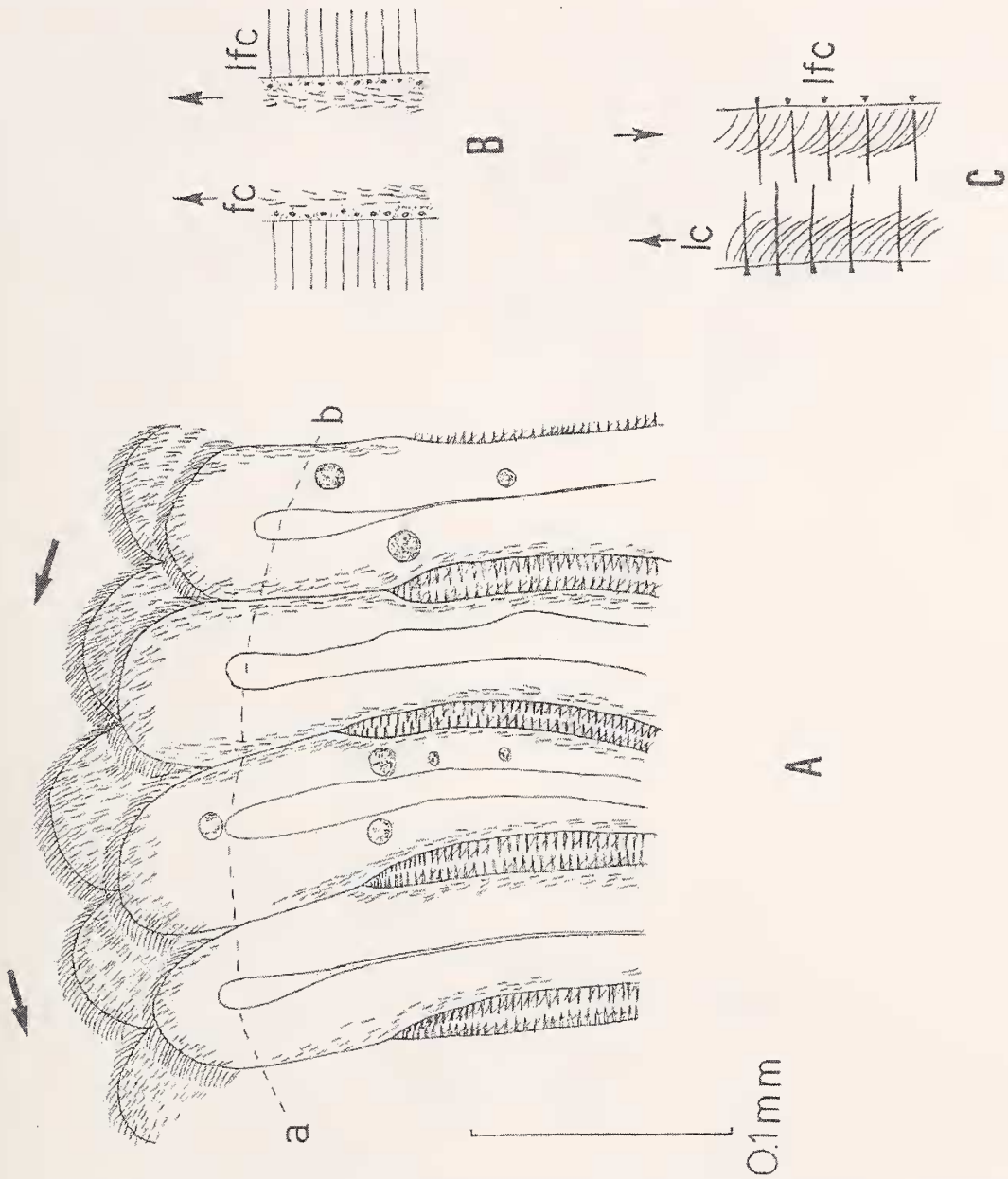

Figure 12. *Bankia fimbriatula*. Marginal groove at the ventral margin of the ctenidium. A. Cilia on the outer surface of the ctenidium; a–b, line of the marginal groove. B. Outer surface of a filament showing the cilia. C. Frontal view between two filaments to show cilia. Abbreviations: fc, frontal cilia; lc, lateral cilia; lfc, latero-frontal cilia; the arrows indicate the direction of ciliary currents, the arrows indicate direction of ciliary currents, including oral one.

The material entering the epibranchial include feces, gametes, excretory products and very small particles which have passed through the demibranchs.

Beside the ciliary currents on the epithelium, frequent contractions were observed throughout the length of the mantle at the epibranchial cavity. The feces were eliminated by short and intermittent jets. No ciliary activity was detected on the wall of the anal canal.

DISCUSSION

The eight simple digitiform tentacles of the inhalant siphon of *B. fimbriatula* and their projection within the inhalant aperture do not act as barriers against particles entering the mantle cavity, but the siphon can regulate the quantity of the material that enters by contracting the circular muscle at the base of the

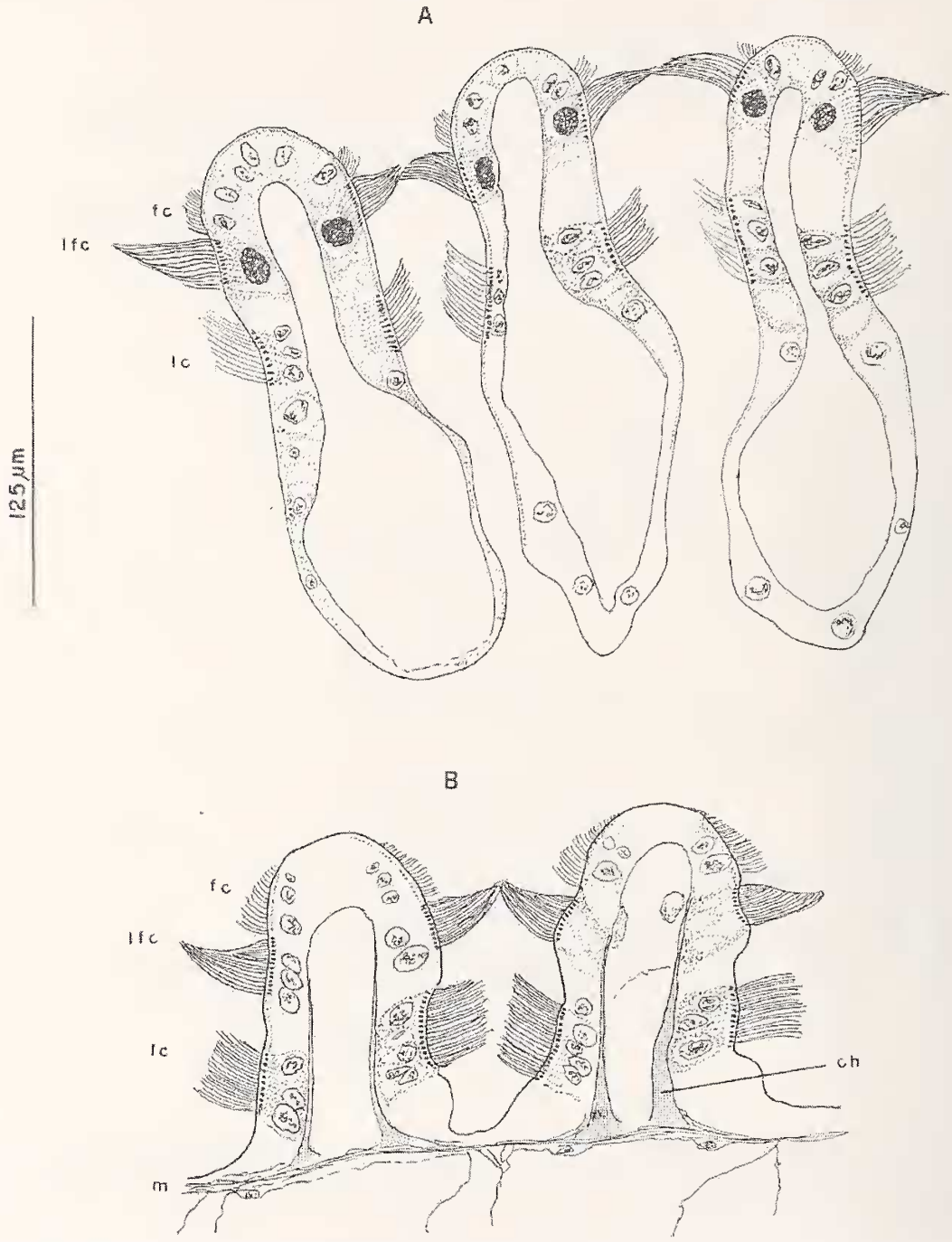

Figure 13. *Bankia fimbriatula*. Transverse sections of the filaments to show cilia. A. Apical filaments. B. Basal filaments. Abbreviations: ch, chitin; fc, frontal cilia; lc, lateral cilia; lfc, latero-frontal cilia; m, horizontal muscles.

tentacle or withdrawing into the interior of the gallery. The ciliary currents of the ctenidia and the efficient rejection tracts of the mantle are responsible for the elimination of rejected particles.

Ciliary activity observed on the tentacles of the inhalant siphon is similar to that described for *N. fusticula* (Lopes & Narchi, 1998) and is apparently related to the removal of small particles which settle around and accumulate on these structures. The retraction and extension movements of the siphons are probably related to the cleaning mechanism, eliminating larger particles which are not removed by ciliary action.

The exhalant siphon is longer than the inhalant and has no digitiform tentacles at the exhalant opening. The exhalant siphon has great flexibility and shows movements of retraction and extension that can make it increase about three times in length. It has many cilia that remove small particles and it is probably sensitive to mechanical stimuli.

The tentacles of the inhalant siphon were described by Townsley et al. (1965) for *B. setacea* and by Lopes & Narchi (1998) for *N. fusticula*. The tentacles of *B. fimbriatula* are different from those described by Lopes & Narchi (1998).

The sensitivity of the siphons of *B. fimbriatula* to mechanical stimuli, even of low intensity, is similar to that reported for other teredinids (Quatrefages, 1849; Saraswathy & Nair, 1971; Lopes & Narchi, 1998).

The siphons of *B. fimbriatula*, contrary to Turner (1966), are not fairly long and separate, but are united at the basal region for at least one third their length.

The mantle of *B. fimbriatula* is similar to that of other teredinids (Sigerfoos, 1908; Lazier, 1924; Turner, 1966; Saraswathy & Nair, 1971; Rancurel, 1971 and Lopes & Narchi, 1998). A thick mantle is apparently generally distributed throughout the family, especially in older specimens, but is nowhere as great as described in *Kuphus* (Guettard, 1770; Turner, 1966). It has been described for *Bankia* by Bade et al. (1961), Sigerfoos (1908) mentions it for *B. gouldi*; Turner (1966) for *Bactronophorus* Tapparone-Canefri, 1877, *Neoteredo* Bartsch, 1920 and *Nausitora* Wright, 1864 and Lopes & Narchi (1998) for *N. fusticula*. In all species having a thick mantle there were also clusters of red-brown, berry-like structures on the transverse fibers of the middle layers. These structures are not present in *B. fimbriatula*.

The rejection tracts of the mantle in *B. fimbriatula* are separate throughout their length as was observed by Sigerfoos (1908) in *B. gouldi*, by Saraswathy & Nair (1971) in *Nausitora hedleyi* Shepman, 1919 and by Lopes & Narchi (1998) in *N. fusticula*. In *Teredo norvegica* [= *Nototeredo norvegica* (Spengler, 1792)] and *Teredo megotara* [= *Psiloteredo megotara* (Hanley, 1848)], studied by Saraswathy & Nair (1971), these tracts are fused at the posterior body region.

In *B. fimbriatula*, these tracts are fused at the posterior body region on the ventral side up to the basal region of the inhalant siphon.

The anterior ctenidium of *B. fimbriatula* is composed of eight or nine filaments. In *B. gouldi* the number of filaments is usually nine, rarely 10 or 11 (Sigerfoos, 1908). Some authors noted a constant number of filaments: Purchon (1941) recorded ten for *N. norvegica* (= *Nototeredo norvagica*)and seven for *P. megotara*; Saraswathy & Nair (1971), eight for *N. hedleyi* and six for *Teredo furcifera* von Martens, 1894. According to Lazier (1924), there are five filaments in *T. navalis*, whereas according to Morton (1970), there are eight. Lopes & Narchi (1998) in *N. fusticula* recorded from six to eight filaments, depending on the specimen. This variation is not correlated with the size of the animal.

According to Lopes & Narchi (1998) the absence of variation in filament number or the discrepancy in numbers of filaments in the same species could be related to small sample size.

The posterior ctenidium of *B. fimbriatula* occupies more than 50% of the body length. According to Turner (1966) species with long ctenidia and more developed palps feed mainly on plankton, wood being a less important source to the animal. The appendix of *B. fimbriatula* makes up 1/3 of the body length, showing that wood is an important source of food. The species have a large appendix and the posterior ctenidia are also well developed. This suggests that plankton, as well as wood particles are important in the nutrition of this species.

In *B. fimbriatula*, the basic anatomy of the ctenidia does not significantly differ from that of other teredinid species described by Ridewood (1903), Sigerfoos (1908) and Lopes & Narchi (1998).

In *B. fimbriatula*, however, the fine frontal cilia are laterally disposed in two tracts in the filament, and the central part is free of cilia. Only at the terminal part of the filament, near the marginal groove, fine cilia cover the entire marginal tip of the filament.

Comparing the anatomical characters described in the present work for *B. fimbriatula* with those of *B. gouldi* described by Sigerfoos (1908), Clapp (1951), Turner (1966) and Tan et al. (1993) we conclude that *B. fimbriatula* differs from *B. gouldi* in terms of the pallets, the presence of eight tentacles around the inhalant siphon and the deep marginal groove in the posterior ctenidium. *Bankia fimbriatula* differs also from *B. gouldi*, *B. setacea*, *B. campanellata* and *B. australis* by the presence of tubular auricles intensively pigmented (Turner, 1966). In addition, *B. fimbriatula* differs from *B. carinata* studied by Bade et al. (1961) and Saraswathy & Nair (1971) in the position of the gonads and the large size of the appendix and the great development of the posterior ctenidia.

According to Turner (1966) the variation exhibited by dissected individuals is considerable. Within the range of the genus much more additional work will be necessary before the many subgenera described on the basis of the pallets can be evaluated.

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